Overview - Polyetheretherketone, Unreinforced

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Subcategory: Polyetheretherketone (PEEK); Polyketone; Polymer; Thermoplastic

Close Analogs: Click the button to view the proprietary polymer grades listed in MatWeb that belong to this class some proprietary polymers may not be listed because they fall into more than one class or because of ambiguity in information.

Proprietary Grades

Key Words: Plastics, Polymers

Click here to view available vendors for this material.

The property data has been taken from proprietary materials in the MatWeb database. Each property value report appropriate MatWeb entries and the comments report the maximum, minimum, and number of data points used to The values are not necessarily typical of any specific grade, especially less common values and those that can be additives or processing methods.

Physical Properties	Metric	English	
Density	1.3 - 1.44 g/cc	0.047 - 0.052 lb/in³	Aver
Water Absorption	0.06 - 0.5 %	0.06 - 0.5 %	Av
Moisture Absorption at Equilibrium	0.2 - 0.5 %	0.2 - 0.5 %	Av
Moisture Vapor Transmission	6.5 cc-mm/m²-24hr-atm	16.5 cc-mil/100 in²-24hr-atm	
Oxygen Transmission	55 cc-mm/m²-24hr-atm	140 cc-mil/100 in²-24hr-atm	
Linear Mold Shrinkage	0.003 - 0.014 cm/cm	0.003 - 0.014 in/in	Ave
Linear Mold Shrinkage, Transverse	0.009 - 0.012 cm/cm	0.009 - 0.012 in/in	A
Melt Flow	4 - 49.5 g/10 min	4 - 49.5 g/10 min	Av
Spiral Flow	7.6 - 22.7 cm	2.99 - 8.94 in	Ave

Mechanical Properties

Hardness, Rockwell M	99 - 105	99 - 105	Average
Hardness, Rockwell R	130	130	
Hardness, Shore D	85	85	
Tensile Strength, Ultimate	90 - 150 MPa	13100 - 21800 psi	Aver
Tensile Strength, Yield	90 - 110 MPa	13100 - 16000 psi	Avera
Elongation at Break	2.5 - 100 %	2.5 - 100 %	Av
Elongation at Yield	5 %	5 %	
Tensile Modulus	3.1 - 8.3 GPa	450 - 1200 ksi	Ave
Flexural Modulus	3.8 - 9.1 GPa	551 - 1320 ksi	Ave
Flexural Yield Strength	110 - 210 MPa	16000 - 30500 psi	Aver
Compressive Yield Strength	29 - 150 MPa	4210 - 21800 psi	Aver
Poisson's Ratio	0.4	0.4	
Shear Modulus	1.3 GPa	189 ksi	
Shear Strength	52 - 80 MPa	7540 - 11600 psi	Avera
Izod Impact, Notched	0.53 - 1.1 J/cm	0.993 - 2.06 ft-lb/in	Aver
Izod Impact, Unnotched	2.7 - 25.6 J/cm	5.06 - 48 ft-lb/in	Avera
Charpy Impact, Unnotched	NB	NB	
Charpy Impact, Notched	0.35 - 3.4 J/cm²	1.67 - 16.2 ft-lb/in²	Avera
Compressive Modulus	3.1 - 4.5 GPa	450 - 653 ksi	Ave
Coefficient of Friction	0.11 - 0.4	0.11 - 0.4	
K (wear) Factor	235 - 250	235 - 250	Average
Limiting Pressure Velocity	0.11 - 0.13 MPa-m/sec	3140 - 3710 psi-ft/min	Avera

Electrical Properties

Electrical Resistivity	1e+015 - 4.9e+016 ohm-cm	1e+015 - 4.9e+016 ohm-cm	Ave
Surface Resistance	1e+016 ohm	1e+016 ohm	
Dielectric Constant	3.2 - 3.45	3.2 - 3.45	Averag
Dielectric Constant, Low Frequency	2.8 - 3.2	2.8 - 3.2	Averag
Dielectric Strength	15.7 - 24 kV/mm	399 - 610 kV/in	Average
Dissipation Factor	0.002 - 0.004	0.002 - 0.004	Av

Dissipation Factor, Low Frequency	0.001	0.001	
Arc Resistance	40 sec	40 sec	
Comparative Tracking Index	150 V	150 V	

Thermal Properties

CTE, linear 20°C	22 - 54 µm/m-°C	12.2 - 30 µin/in-°F	Av
CTE, linear 100°C	22 - 50 µm/m-°C	12.2 - 27.8 µin/in-°F	Av
CTE, linear 250°C	35 - 94 µm/m-°C	19.4 - 52.2 µin/in-°F	Av
Heat Capacity	1.85 - 2.16 J/g-°C	0.442 - 0.516 BTU/lb-°F	Av
Thermal Conductivity	0.24 - 0.25 W/m-K	1.67 - 1.74 BTU-in/hr-ft²-°F	Average
Melting Point	340 - 344 °C	644 - 651 °F	Av
Maximum Service Temperature, Air	154 - 315 °C	309 - 599 °F	Av
Deflection Temperature at 1.8 MPa (264 psi)	154 - 295 °C	309 - 563 °F	Av
Brittleness Temperature	-65 °C	-85 °F	
Glass Temperature	140 °C	284 °F	
UL RTI, Electrical	260 °C	500 °F	
UL RTI, Mechanical with Impact	180 °C	356 °F	
UL RTI, Mechanical without Impact	240 °C	464 °F	
Flammability, UL94	V-0	V-0	
Oxygen Index	35 - 43 %	35 - 43 %	Av

Processing Properties

Processing Temperature	360 - 370 °C	680 - 698 °F	Av
Rear Barrel Temperature	340 - 350 °C	644 - 662 °F	Av
Middle Barrel Temperature	360 - 370 °C	680 - 698 °F	Av
Front Barrel Temperature	370 - 380 °C	698 - 716 °F	Av
Nozzle Temperature	370 - 380 °C	698 - 716 °F	Av
Mold Temperature	180 °C	356 °F	
Drying Temperature	150 °C	302 °F	

Overview - Polyamide-Imide, Glass Filled

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Subcategory: Filled/Reinforced Thermoplastic; Polyamide-imide; Polymer; Thermoplastic

Close Analogs: Click the button to view the proprietary polymer grades listed in MatWeb that belong to this class some proprietary polymers may not be listed because they fall into more than one class or because of ambiguity in information.

Proprietary Grades

Key Words: PAI; Plastics, Polymers

Click here to view available vendors for this material.

The property data has been taken from proprietary materials in the MatWeb database. Each property value report appropriate MatWeb entries and the comments report the maximum, minimum, and number of data points used to The values are not necessarily typical of any specific grade, especially less common values and those that can be additives or processing methods.

Physical Properties	Metric	English	
Density	1.6 - 1.61 g/cc	0.0578 - 0.0582 lb/in³	Average = 1
Water Absorption	0.18 - 0.3 %	0.18 - 0.3 %	Average = 0.
Moisture Absorption at Equilibrium	1.5 - 1.7 %	1.5 - 1.7 %	Average = 1
Mechanical Properties			
Hardness, Rockwell E	85 - 94	85 - 94	Average =
Hardness, Rockwell M	130	130	
Hardness, Shore D	90	90	
Tensile Strength, Ultimate	95 - 180 MPa	13800 - 26100 psi	Average = 1
Tensile Strength, Yield	220 MPa	31900 psi	
Elongation at Break	2.3 - 4 %	2.3 - 4 %	Average = 3
Tensile Modulus	6 - 14.6 GPa	870 - 2120 ksi	Average = 8.
Flexural Modulus	6.2 - 11.7 GPa	899 - 1700 ksi	Average = 9.
Flexural Yield Strength	138 - 335 MPa	20000 - 48600 psi	Average = 2

Compressive Yield Strength	186 - 315 MPa	27000 - 45700 psi	Aver
Shear Strength	170 MPa	24700 psi	
Izod Impact, Notched	0.37 - 0.8 J/cm	0.693 - 1.5 ft-lb/in	Average = 0
Charpy Impact, Notched	0.35 J/cm²	1.67 ft-lb/in²	
Compressive Modulus	4.1 - 5.6 GPa	595 - 812 ksi	Ave
Coefficient of Friction	0.2	0.2	
K (wear) Factor	275 - 300	275 - 300	Average =
Limiting Pressure Velocity	0.18 MPa-m/sec	5140 psi-ft/min	

Electrical Properties

Electrical Resistivity	1e+014 - 2e+017 ohm-cm	1e+014 - 2e+017 ohm-cm	Average =
Surface Resistance	1e+018 ohm	1e+018 ohm	
Dielectric Constant	4.2 - 6.5	4.2 - 6.5	Averag
Dielectric Constant, Low Frequency	4.4	4.4	
Dielectric Strength	27.6 - 34 kV/mm	701 - 864 kV/in	Average
Dissipation Factor	0.022 - 0.05	0.022 - 0.05	Average = 0
Dissipation Factor, Low Frequency	0.022	0.022	

Thermal Properties

CTE, linear 20°C	16 - 47 µm/m-°C	8.89 - 26.1 µin/in-°F	Average
CTE, linear 20°C Transverse to Flow	16 µm/m-°C	8.89 µin/in-°F	
CTE, linear 100°C	25 µm/m-°C	13.9 µin/in-°F	
Thermal Conductivity	0.36 W/m-K	2.5 BTU-in/hr-ft²-°F	
Maximum Service Temperature, Air	220 - 270 °C	428 - 518 °F	Average = 2
Deflection Temperature at 1.8 MPa (264 psi)	271 - 282 °C	520 - 540 °F	Average =
Glass Temperature	280 °C	536 °F	
UL RTI, Electrical	220 °C	428 °F	
UL RTI, Mechanical with Impact	200 °C	392 °F	
UL RTI, Mechanical without Impact	220 °C	428 °F	
Flammability, UL94	V-0	V-0	
Oxygen Index	50 %	50 %	

PEEK Flexural Properties

PEEK™ polymer and the high-performance compounds based on PEEK™ polymer exhibit outstanding flexural performance over a wide temperature range. Due to the viscoelasticity of these materials, evaluations were performed using a defined strain rate three point bending test (standards ISO R178 and ASTM D790) with the results plotted versus temperature in Figures 4 and 5.

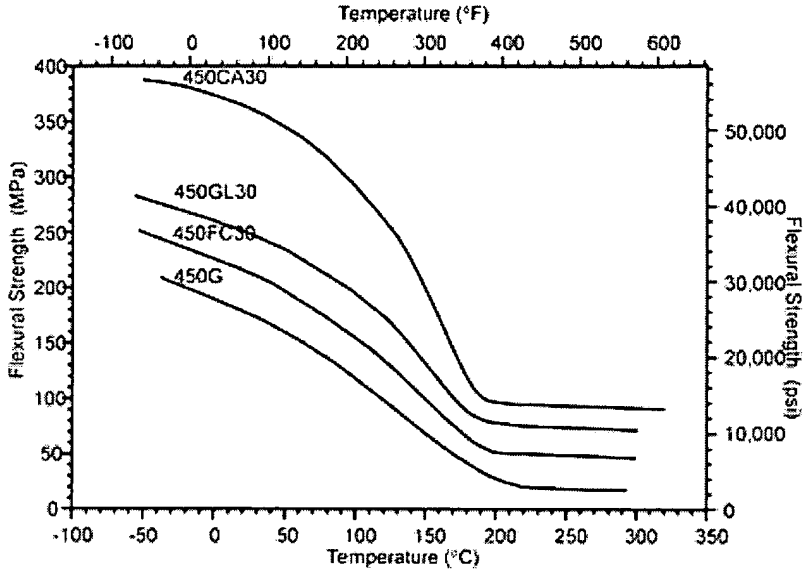

Figure 4 - Flexural Strength Versus Temperature for PEEK™ Polymer Materials

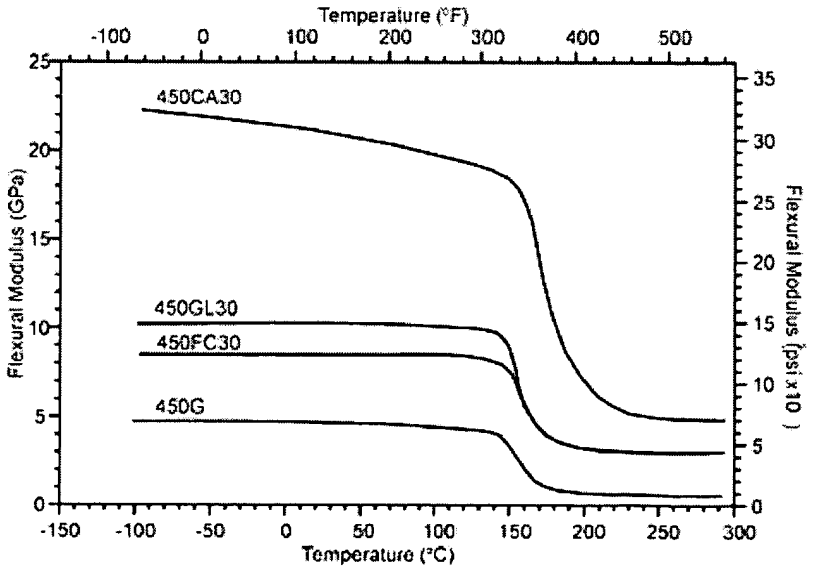

Figure 5 - Flexural Modulus Versus Temperature for PEEK™ Polymer Materials

Flexural strength has been defined as the maximum stress sustained by the test specimen during bending, and flexural modulus as the ratio of stress to strain difference at pre-defined strain values.

The data plotted in Figures 4 and 5 define the exceptional temperature range over which PEEK™ polymer can be used as a structural material. However, flexural strength measurements made above 392°F (200°C) are subject to error as the yield point of these materials is at greater than the 5% strain specified in the test standard. Above this value, a linear stress to strain relationship cannot be assumed for the calculation of flexural properties.

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IMIDEX

Imidex (thermoplastic polyimide) data sheet

Westlake introduces Imidex, a unique new thermoplastic polyimide film made from AURUM® resin.

Possible Applications:

- Electronics
- Acoustics
- Composites
- Wire/Cable insulation
- Adhesive film
- Washers and gaskets

Featured Advantages of Imidex:

- High heat resistance
- High tensile and tear strength
- Excellent resistance to oil, many chemicals, sunlight, and radiation
- Amber in color and fairly transparent

Manufacturing Capabilities:

- Film: .001" - .029"up to 26" wide
- Sheet: .030" - .040" up to 24" wide polish/matte finish

	Units	Method	Result
THERMAL			
Continuous use temperature	°F	-	446 (230°C)
Melting point	°F	-	730 (388°C)
Coefficient of thermal conductivity	W/m•K	-	0.18
Coefficient of linear expansion	x 10^{-6}cm/cm/K	-	55
MECHANICAL			
Tensile strength	MPa (psi)	ASTM D882	118 (17,100)
Tensile elongation	%	ASTM D882	110
Tensile modulus	MPa (psi)	ASTM D882	3,060 (442,780)
Tensile impact	ft.lb/sq in	ASTM D1822	94
Tear strength, propagation	lbs	ASTM D1922	2.8
Tear strength, initiation	lbs	ASTM D1004	50.4
Flexural modulus	MPa (psi)	ASTM D790	3,779 (548,000)
ELECTRICAL			
Flammability	-	UL94	V-0 @ 16 mil
Radiation resistance	-	γ Ray β Ray	10,000 mega rad 12,000 mega rad
1 mil film tested:			
Capacitance	-	ASTM D150	364.0
Dielectric constant	@ 1kHz	ASTM D150	2.50
Dissipation factor	-	ASTM D150	.0014
Dielectric breakdown	kV	ASTM D149	6.29
Dielectric strength	V/mil	ASTM D149	6,290
CHEMICAL RESISTANCE			
O_2 permeability	cc/m²/atm/24 hr	ASTM D3938	135 @ 0.8 mil
H_2O permeability	g/m²/atm/24 hr	ASTM E96	85 @ 1.4 mil
Water absorption (24 hr)	%@50°C•75%		1.0

	RH•24hr		
10% HCI aqueous	-	Mitsui	No change
30% NaOH aqueous	-	Mitsui	No change
Toluene	-	Mitsui	No change
MEK	-	Mitsui	No change
OTHER			
Specific gravity	-	ASTM D792	1.33
Haze	%	ASTM D1003	0.1
Light transmission	%	ASTM D1003	64 @ 1.4 mil

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High Temperature Material Selection Guide

Click Here For The Material Selection Guide

Introduction

All of the materials covered in this guide are also covered in our Thermoplastic Selection Guide. However, these nine (9) material types have the capability of continuous use at 300 degrees F or above. This puts them on the high end of thermoplastic materials, both in performance and cost. All of these materials require special consideration to process properly. Proper processing is essential to acheiving the full potential of these materials.

Materials Covered By this Guide:

ETFE (Tefzel)
LCP (Polyester Liquid Crystal Polymer)
PEEK Polyetheretherkeytone
PEI Polyetherimid (Ultem)
Polyethersulfone
Polyimide (Thermoplastic) (Aurum)
PPA Polyphthalamide
PPS Polyphenylene Sulfide
Polysulfone

ETFE Fluropolymer (Tefzel)

General Description
ETFE is a melt processable fluropolymer. It is similar in properties to other fluropolymers, having excellent lubricity (Fluropolymers have the lowest coefficient of friction of any plastic material), wear resistance , and excellent chemical resistance. ETFE is nothing special when it comes to mechanical properties, but it does have excellent impact strength and fatigue resistance.

Tensile Strength
6000-12000 psi

Flexural Modulus

200,000-900,000 psi

Impact Strength
9- No Break ft-lb/in notched izod

Maximum Temp.
400 F+ depending upon load and grade

Chemical Resistance
Excellent

Cost
$$$$$$$$

Brand Names
Tefzel (Dupont)

Material Mfg.
Dupont

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LCP (Polyester Liquid Crystal Polymer)

General Description
LCPs are cool, relatively new materials with interesting properties. They have tensile strength and modulus close to aluminum.

Because of the highly oriented, rod like nature, of the polymer molecules, LCPs present some interesting design challenges. This is because the molecules will only form in straight lines. Additionally, the high orientation only occurs within about .040 of the surface of the part. Molecular orientation below this skin is random. As a result all of the strength of the material is in the skin.

Good design data is not available for these materials, so prototyping is a must. prototypes must be molded, because of the molecular orientation mentioned above.

Tensile Strength
12,000-32,000 psi

Flexural Modulus 1,300,000-4,600,000 psi with carbon fiber
3.2x10E6 with glass fiber

Impact Strength
1.1-11 ft-lb/in notched izod

Maximum Temp.
500 F short duration 400 F long term

Chemical Resistance
Good to Excellent

Cost
$$$$$$$$

Brand Names
Vectra (Hoechst Celanese)
Xydar (Amoco)

Material Mfg.
Amoco, Hoechst Celanese

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PEEK Polyetheretherkeytone

General Description
PEEK is a high temperature, high cost, semi-crystalline material with excellent mechanical properties and chemical resistance.

Tensile Strength
14,000-41,000 psi with carbon fiber

Flexural Modulus
440,000-2,400,000 psi

Impact Strength
0.9-3.0 ft-lb/in notched izod

Maximum Temp.
600 F short duration 480 F long term

Chemical Resistance Good to Excellent

Cost
$$$$$$$$$$$$$$$$$!!! (expensive stuff)

Brand Names
Victrex (ICI), Thermocomp (LNP)

Material Mfg.
ICI, LNP

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PEI Polyetherimid (Ultem)

General Description
PEI is an amorphous, high temperature material with relatively low cost compared to other high temperature materials. It has excellent elongation and impact strength, and can be molded to tight tolerances. Its chemical resistance is not as good as crystalline materials but is excellent for an amorphous material.

PEI behaves similar to polycarbonate, but can perform at higher temperatures.

Tensile Strength
14,000-28,000 psi

Flexural Modulus
480,000-1,300,000 psi

Impact Strength
2 ft-lb/in notched izod
25 ft-lb/in un-notched

Maximum Temp.
420 F short duration 375 F long term

Chemical Resistance
Fair to Good

Cost
$$$$$

Brand Names
Ultem (GE)

Material Mfg.
GE

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PES Polyethersulfone

General Description
Polyethersulfone is a high temperature amorphous material with relatively low cost. PES has slightly lower capabilities than PEI at about the same cost. As a result it is not widely used.

Tensile Strength
9,500-18,000 psi

Flexural Modulus
590,000-1,200,000 psi

Impact Strength
1.4 ft-lb/in notched izod

Maximum Temp.
400 F short duration 350 F long term

Chemical Resistance
Good to Excellent

Cost
$$$$$$

Brand Names

Thermocomp (LNP), Victrex (ICI)

Material Mfg.
LNP, ICI

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Polyimide (Thermoplastic) (Aurum)

General Description
Polyimides offer excellent properties at high temperatures. A thermoplastic version of this material became available recently. Both amorphous and crystalline grades are offered. Polyimide materials are attacked by alkali and are very expensive.

Tensile Strength
13,000-36,000 psi

Flexural Modulus
420,000 -2,800,000 psi

I,pact Strength
1.7-2.2 ft-lb/in notched izod

Maximum Temp.
580+ F short duration 450 F long term

Chemical Resistance
Good - attacked by alkali

Cost
$$$$$$$$$$$$$$$!!! (expensive stuff)

Brand Names
Aurum (Mitsui Toatsu)

Material Mfg.
Mitsui Toatsu

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PPA Polyphthalamide (Amodel)

General Description
PPA is a relatively new, semi-crystalline material, with an excellent cost to performance ratio. PPA bridges the performance gap between nylons/polyesters, and higher priced, high temperature materials such as PEI and PEEK. PPA has excellent impact strength and is not notch sensitive. Verton, long glass fiber material from LNP is an excellent metal replacement material

PPA does absorb moisture, and its properties change as a result. _This change is not nearly as great as 6-6 nylon. Despite its relatively recent introduction, good design data is available for PPA.

Tensile Strength
9,000-33,000 psi

Flexural Modulus
270,000 -2,700,000 psi

Impact Strength
.6-22 ft-lb/in notched izod

Maximum Temp.
450+ F short duration 300 F long term

Chemical Resistance
Good to Excellent, unacceptable in phenols

Cost
$$$$

Brand Names
Amodel (Amoco), Verton (LNP)

Material Mfg.
Amoco, LNP

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PPS Polyphenylene Sulfide

General Description
PPS is a high temperature semi-crystalline material. It has good mechanical properties and excellent chemical resistance at elevated temperatures. PPS has been compounded extensively and many different types of properties are available. PTFE filled PPS is one of the best bearing materials available.

Unfilled grades of PPS have poor properties, so components are usually made from glass filled or glass/mineral filled grades.

PPS is very sensitive to molding conditions and must be processed properly to achieve its maximum potential.

Tensile Strength
14,000-28,000 psi

Flexural Modulus
550,000 -2,900,000 psi

Impact Strength
.5-6 ft-lb/in notched izod

Maximum Temp.
500+ F short duration 450 F long term

Chemical Resistance
Good to excellent

Cost
$$$$ to $$$$$$$

Brand Names
Fortron (Hoechst Celanese)
Lubricomp (LNP)
Ryton (Phillips)
Supec (GE)

Material Mfg.
GE, Hoechst Celanese, LNP, Phillips

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Polysulfone

General Description
Polysulfone is a high temperature amorphous material with relatively low cost. It is transparent and can be used at temperatures of up to 300 F. Polysulfone has been compounded, with glass and mineral filled grades available.

Tensile Strength
9,500-18,000 psi

Flexural Modulus
390,000-1,500,000 psi

Impact Strength
.65-7 ft-lb/in notched izod

Maximum Temp.
350 F short duration 300 F long term

Chemical Resistance
Fair to Good

Cost
$$$$$

Brand Names
Udel and Mindel(Amoco)

Material Mfg.
Amoco

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PARKWAY
PRODUCTS, INC

Ultem® / Polyether-imide

peek
phenolic
torlon
urethane
ultem/polyether-imide

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Ultem

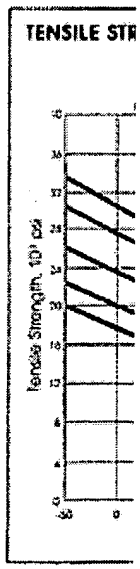
Polyetherimide (marketed by GE Plastics under the trade name Ultem®) is a high-performance thermoplastic. This material is characterized by high strength and rigidity at elevated temperatures, long-term heat resistance, highly dimensional stability, good electrical properties, broad chemical resistance and is injection moldable. Also, it exhibits an inherent flame resistance and a low smoke generation without the need for incorporating additives. Unmodified polyetherimide material is amber transparent in color.

CHEMICAL RESISTANCE
Polyetherimide resists a wide range of chemicals including most hydrocarbons, alcohol's, an mineral acids and tolerates short-term exposure to mild bases. Partially halogenated solvent

HYDOLYTIC STABILITY
Hydrolytic stability is good with greater than 85% tensile strength retention after 10,000-hr. b tensile strength retention after 2000 steam autoclaving cycles at 270°F.

RADIATION RESISTANCE Polyetherimide has good resistance to UV and gamma radiation tensile strength after treatment of 400 megarads of cobalt irradiation.

HEAT RESISTANCE Polyetherimide resins are rated for 338°F and 356°F continuous-use temperatures by Underwriters Laboratories, and are UL 94-VO listed down to 10 mils thickness depending on grade. Oxygen index is 47%.



Polyetherimide complies with FAA flammability and heat release requirements for aircraft interior applications.

Glass transition temperatures of 419°F and greater allow intermittent use at 392°F. and short-term excursions to higher temperatures. At 356°F., the tensile strength and flexural modulus are more than 6,000 and 300,000 psi, respectively. Higher strength and stiffness at elevated temperatures to the material's glass transition (Tg) are obtained with glass or carbon fiber reinforcement.

Long-term resistance to creep at high temperatures and stress levels allows polyetherimide to replace metal and other materials in many structural applications.

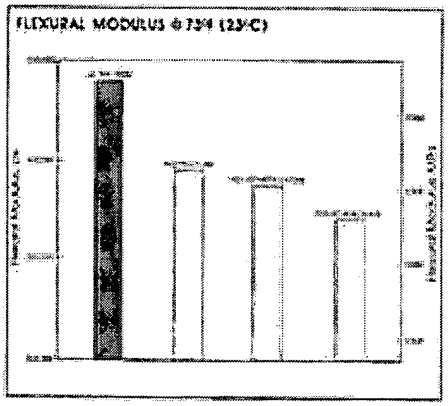
ELECTRICAL
Electrical properties show very good stability under variable temperature, humidity, and frequ

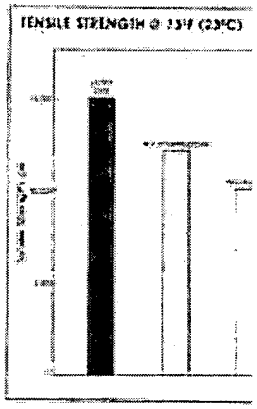
OTHER PROPERTIES
Low dissipation factor at GHz frequencies makes polyetherimide highly transparent to microw

The material also has low levels of ionic contaminants with conductivity of the water extract s hr. extraction at 250°F., 100% RH, and 30 p.s.i.g., making it suitable for use as an insulation components.

GRADES
Resins are offered in the following grades: unreinforced; glass fiber-reinforced; easy-flow and grades; carbon fiber-reinforced grades for high strength and static dissipation; and a family o higher heat defection temperatures and 392°F. service. Other grades and blends for structur materials for EMI shielding, new resin systems for advanced composites and spun polyether

PROPERTY	ULTEM 1000 (Unreinforced)	ULTEM 2300 (30% Glass Reinforced)	(
Mechanical: Tensile Strenght, yield, Type 1, 0.125" (3.2mm) Flexural Modulus, 0.125" (3.2mm)	 15,200 psi 480,000 psi	 24,500 psi 1,300,000 psi	 31 2,
Impact: Izod Impact, notched, 73°F (23°C)	1.0 ft-lb/in	1.6 ft-lb/in	7.
Physical: Specific Gravity, solid Water Absorption, 24 hours @ 73°F (23°C)	 1.27 0.250	 1.51 0.160	 1. ---
Electrical: Dielectric Strength, in air, 62 mils (1.6mm)	 831 V/mil	 770 V/mil	 ---

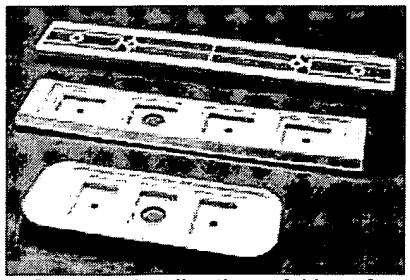




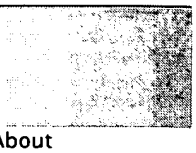
PROCESSING
Polyetherimide materials can be machined using conventional, laser, and water jet technique ultrasonic, vibrational, and hot platen welding plus mechanical fastening, adhesive, and solve

APPLICATIONS

Transportation
Electrical/Electronic Appliances
Medical Components
Industrial Uses
Packaging
Appliances
Jet Engine Components


Sample Application of Aircraft Interior Ultem Parts

Parkway Products, Inc. is the acknowledged leader in carbon filled Ultem molding and ranks North America.



Technical Information

Dow Plastics

TYRIL 880

Styrene-Acrylonitrile Copolymer

TYRIL* 880 resin is a high performance SAN copolymer that offers improved chemical resistance, physical properties, and practical toughness over TYRIL 100 resin. TYRIL 880 resin is used for both injection molded and extruded applications. The principal application for TYRIL 880 SAN copolymer is industrial battery cases. TYRIL 880 SAN copolymer is available in Natural (light yellow) color only.

Drying(1)

A hopper dryer with a dehumidifying unit and a dew point of -20°F (-29°C) is recommended. TYRIL 880 SAN copolymer should be dried at a temperature of 160°F to 180°F (71°C to 82°C) for 2 to 4 hours. A pellet moisture level of 0.1% or less is recommended to avoid splay marks or streaking in fabricated parts.

Typical Barrel Profile and Processing Conditions(1)

Rear:	400°F (204°C)
Middle:	425°F (218°C)
Front:	450°F (232°C)
Nozzle:	440°F (227°C)
Melt:	390°F to 450°F (200°C to 232°C)
Mold:	80°F to 120°F (25°C to 50°C)

Properties(2)	English Values	English Units	S.I. Values	S.I. Units	Metric Values	Metric Units	Test Method
Injection Molded(3)							
Melt Flow Rate (230°C/3.8 kg)	3.3	g/10 min	3.3	g/10 min	3.3	g/10 min	ASTM D 1238
Specific Gravity	1.08		1.08		1.08		ASTM D 792
Yield Tensile Strength	11,300	psi	77.9	MPa	794	Kg(f)/cm²	ASTM D 638
Ultimate Tensile Strength	11,300	psi	77.9	MPa	794	Kg(f)/cm²	ASTM D 638
Ultimate Elongation	2.9	%	2.9	%	2.9	%	ASTM D 638
Tensile Modulus	516,000	psi	3,560	MPa	36,300	Kg(f)/cm²	ASTM D 638
Flexural Strength	17,900	psi	123	MPa	1250	Kg(f)/cm²	ASTM D 790
Flexural Modulus	560,000	psi	3,860	MPa	39,400	Kg(f)/cm²	ASTM D 790
Izod Impact Strength(4)	0.4	ft-lb/in	21	J/M	210	Kg(f)/cm/cm	ASTM D 256
Deflection Temperature Under Load(5)							
66 psi (0.45 MPa), unannealed	207	°F	97	°C	97	°C	ASTM D 648
264 psi (1.8 MPa), unannealed	187	°F	86	°C	86	°C	ASTM D 648
66 psi (0.45 MPa), annealed	215	°F	102	°C	102	°C	ASTM D 648
264 psi (1.8 MPa), annealed	209	°F	98	°C	98	°C	ASTM D 648
Vicat Softening Point	228	°F	109	°C	109	°C	ASTM D 1525
Rockwell Hardness	126	R scale	126	R scale	126	R scale	ASTM D 785
Transmittance	91.7	%	91.7	%	91.7	%	ASTM D 1003
Haze	0.6	%	0.6	%	0.6	%	ASTM D 1003
Mold Shrinkage	0.003 to 0.007	in/in	0.003 to 0.007	cm/cm	0.003 to 0.007	cm/cm	ASTM D 955
Linear Thermal Expansion	3.3×10^{-5}	in/in/°F	6.0×10^{-5}	cm/cm/°C	6.0×10^{-5}	cm/cm/C	ASTM D 696
Flammability(6)	HB		HB		HB		UL-94
Limiting Oxygen Index(6)	19	%	19	%	19	%	ASTM D 2863

(1) Please note for both drying and melt temperatures these are actual temperature aim points and not machine settings.
(2) Typical properties; not to be construed as specifications.
(3) Injection molded test bars 0.125" x 0.5" (0.32 cm x 1.28 cm) cross-sectional area.
(4) 0.125" thick specimen, notched (73°F [23°C]).
(5) 0.125" thick specimen.
(6) This numerical flammability rating is not intended to reflect hazards presented by this or any other material under actual fire conditions.

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– See "Handling Considerations" reverse side.

Safety and Handling Considerations

Material Safety Data (MSD) sheets for TYRIL* Styrene-Acrylonitrile copolymers are available from Dow Plastics, a business group of The Dow Chemical Company and its subsidiaries. MSD sheets are provided to help customers satisfy their own handling, safety, and disposal needs, and those that may be required by locally applicable health and safety regulations, such as OSHA (U.S.A.), MAK (Germany), or WHMIS (Canada). MSD sheets are updated regularly, therefore, please request and review the most current MSD sheet before handling or using any product.

The following comments are general and apply only to TYRIL Styrene-Acrylonitrile copolymers as supplied.

Various additives and processing aids used in fabrication and other materials used in finishing steps have their own safe use profile and must be investigated separately.

Hazards and Handling Precautions

TYRIL Styrene-Acrylonitrile copolymers have a very low degree of toxicity and under normal conditions of use should pose no unusual problems from ingestion, eye, or skin contact. However, caution is advised when handling, storing, using, or disposing of these resins and good housekeeping and controlling of dusts are necessary for safe handling of product. Workers should be protected from the possibility of contact with molten resin during fabrication.

Handling and fabrication of plastic resins can result in the generation of vapors and dusts. Dusts resulting from sawing, filing, and sanding of plastic parts in post-molding operations may cause irritation to eyes and the upper respiratory tract. In dusty atmospheres, use an approved dust respirator.

Pellets or beads may present a slipping hazard.

Good general ventilation of the polymer processing area is recommended.

Processing may release fumes which may include polymer fragments and other decomposition products. Fumes can be irritating. At temperatures exceeding melt temperature, polymer fragments can occur. Good general ventilation should be sufficient for most conditions. Local exhaust ventilation may be necessary for some operations.

Use safety glasses. If there is a potential for exposure to particles which could cause mechanical injury to the eye, wear chemical goggles. If vapor exposure causes eye discomfort, use a full-face respirator. No other precautions other than clean body-covering clothing should be needed for handling TYRIL Styrene-Acrylonitrile copolymers. Use gloves with insulation for thermal protection, when needed.

Combustibility

TYRIL Styrene-Acrylonitrile copolymers will burn and, once ignited, may burn rapidly under the right conditions of heat and oxygen supply. Do not permit dust to accumulate. Dust layers can be ignited by spontaneous combustion or other ignition sources. When suspended in air, dust can pose an explosion hazard. Dense black smoke is produced when product burns. Toxic fumes are released in fire situations.

Fire fighters should wear positive-pressure, self-contained breathing apparatus and full protective equipment. Water or water fog are the preferred extinguishing media. Foam, alcohol resistant foam, carbon dioxide, or dry chemicals may also be used. Soak thoroughly with water to cool and prevent re-ignition.

Disposal

DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. For unused or uncontaminated material, the preferred options include sending to a licensed recycler, reclaimer, incinerator, or other thermal destruction device. For used or contaminated material, the disposal options remain the same although additional evaluation is required (see, for example, in the U.S.A., 40 CFR, Part 261, "Identification and Listing of Hazardous Waste"). All disposal methods must be in compliance with Federal, State/Provincial, and local laws and regulations.

As a service to its customers, Dow can provide lists of companies which recycle, reprocess, or manage chemicals or plastics, and companies that manage used drums. Contact the nearest Dow Customer Service Center for further details.

Environment

Generally speaking, in the environment lost pellets are not a problem except under unusual circumstances — when they enter the marine environment. They are inert and benign in terms of their physical environmental impact, but if ingested by waterfowl or aquatic life, they may mechanically cause adverse effects. Spills should be minimized and they should be cleaned up when they happen. Plastics should not be discarded into the ocean or any other body of water.

Product Stewardship

The Dow Chemical Company has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis of our Product Stewardship philosophy, by which we assess the health and environmental information on our products and then take appropriate steps to protect employee and public health and the environment. Our Product Stewardship program rests with every individual involved with Dow products from initial concept and research to the manufacture, sale, distribution, and disposal of each product.

Customer Notice

Dow encourages its customers and potential users of Dow products to review their applications for such products from the standpoint of human health and environmental quality. To help ensure that Dow products are not used in ways for which they were not intended or tested, Dow personnel will assist customers in dealing with ecological and product safety considerations. Your Dow sales representative can arrange the proper contacts. Dow literature, including Material Safety Data sheets, should be consulted prior to the use of Dow products. These are available from the nearest Dow Customer Service Center.

For additional information in the U.S. and Canada, call 1-800-441-4DOW (4369).
In Mexico, call 95-800-441-4369.

Dow will not knowingly sell or sample any products into any commercial or developmental application which is intended for:

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b. Use in cardiac prosthetic devices regardless of the length of time involved (cardiac prosthetic devices include, but are not limited to, pacemaker leads and devices, artificial hearts, heart valves, intra-aortic balloons and control systems and ventricular bypass assisted devices);

c. Use as a critical component in medical devices that support or sustain human life; or

d. Use specifically by pregnant women or in applications designed specifically to promote or interfere with human reproduction.

In addition, for Dow Engineering Plastics products, new business opportunities require a business assessment prior to sale or sampling Dow products.

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